UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/756,603	01/13/2004	Uttam Ghoshal	089-0005	1623

22120 7590 12/27/2007

ZAGORIN O'BRIEN GRAHAM LLP
7600B NORTH CAPITAL OF TEXAS HIGHWAY
SUITE 350
AUSTIN, TX 78731

EXAMINER	
BARTON, JEFFREY THOMAS	

ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
12/27/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/756,603	GHOSHAL, UTTAM	
	Examiner	Art Unit	
	Jeffrey T. Barton	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 October 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,8-12 and 15-34* is/are pending in the application.

4a) Of the above claim(s) *19-29 and 34* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,8-12,15-18 and 30-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :20040113, 20050203, 20050314, 20050527, 20050701, 20070726, and 20070914.

DETAILED ACTION

Election/Restrictions

1. Applicant's election of Group I, claims 1-4, 8-12, 15-18, and 30-34 in the reply filed on 12 October 2007 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). The Examiner inadvertently indicated claim 34 as part of elected Group I, although it clearly belongs to group II, as it is a method claim dependent upon claim 29, distinct from the claims of Group I for the reasons indicated in the restriction requirement. Accordingly claim 34 is withdrawn along with claims 19-29. Claims 1-4, 8-12, 15-18, and 30-33 will be examined herein.

Claim Objections

2. Claim 15 is objected to because of the following informalities: In lines 10-11, "the second electrode the second electrode" is recited, although it is clear that "the second electrode" was intended. Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

4. Claims 1-4, 8, 10, 18, and 30-32 are rejected under 35 U.S.C. 102(a) as being anticipated by Takazawa et al. (JP 2003-037300)

Regarding claims 1 and 18, Takazawa et al discloses a thermoelectric device (Figure 1) comprising a first electrode; a second electrode; a first thermoelement disposed between the first and second electrodes and coupled to the first electrode (Figure 1, electrodes 24 and 25, elements 23); a phonon conduction impeding medium as claimed (Paragraphs 0020 and 0024; liquid metal disposed on both sides of each element 23; the liquid metal adjacent the second electrode is thermally isolated from the first electrode); and a dielectric material maintaining spacing between electrodes as claimed (Component holder 30, made of Bakelite; Paragraph 0026) The liquid metal disposed at either end of the thermoelements 23 (Paragraph 0020) reads on the first and second phonon conduction impeding media of claim 18.

Regarding claim 2, the phonon conduction impeding medium of Takazawa et al is liquid metal. (Paragraph 0020)

Regarding claims 3 and 4, Takazawa et al disclose using indium and gallium as the liquid metal (Paragraph 0024) and using a bismuth chalcogenide for the thermoelements. (Paragraph 0026)

Regarding claim 8, the thermoelements 23 of Takazawa et al are connected electrically in series and thermally in parallel. (Figure 1; Paragraphs 0019-0026)

Regarding claim 10, Takazawa et al disclose providing a temperature gradient across the device to provide power generation. (Paragraphs 0002 and 0029)

Regarding claim 30, Takazawa discloses providing liquid metal at both ends of thermoelement 23, which provides a second phonon conduction impeding medium coupled to the first electrode in addition to the medium thermally insulated from the first electrode.

Regarding claim 31, in the series-connected system of Takazawa et al, since each electrode (24 and 25) is connected across two thermoelements 23 in series, and each thermoelement 23 is provided with a liquid metal layer at either end (Paragraph 0020), the system provides a second phonon conduction impeding medium disposed between the second electrode and a third electrode, and a second thermoelement having opposite conductivity type to the first thermoelement coupled to the second phonon conduction impeding medium and coupled to the third electrode. (Figure 1)

Regarding claim 32, since the liquid metal is applied directly to the ends of the thermoelements (Paragraph 0020), it is considered to be directly coupled thereto.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takazawa et al in view of Bejan. (Advanced Engineering Thermodynamics section cited on IDS of 03 February 2005)

Takazawa et al discloses a thermoelectric device as described above in addressing claims 1-4, 8, 10, 18, and 30-32.

Takazawa et al do not explicitly disclose connecting the thermoelectric device to a power source for operation as a cooler.

Bejan teaches that thermoelectric generation devices having hot and cold junctions (i.e. Figure 12.7 of Bejan) can be used as thermoelectric coolers by connection to a power source. (Section 12.4.6)

It would have been obvious to one having ordinary skill in the art to modify the system of Takazawa et al by connecting the electrodes to a power supply to provide cooling at one side of the device, as taught by Bejan et al, because Bejan teaches that thermoelectric generators of this possess this capability. It is notoriously well known in this art that series connected n- and p-type thermoelements can operate either as electrical generators or heating/cooling devices. It would have been well within the abilities of a skilled artisan to select either application based on whichever function is required.

8. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takazawa et al in view of Ghoshal. (US 6,222,113)

Takazawa et al discloses a thermoelectric device as described above in addressing claims 1-4, 8, 10, 18, and 30-32.

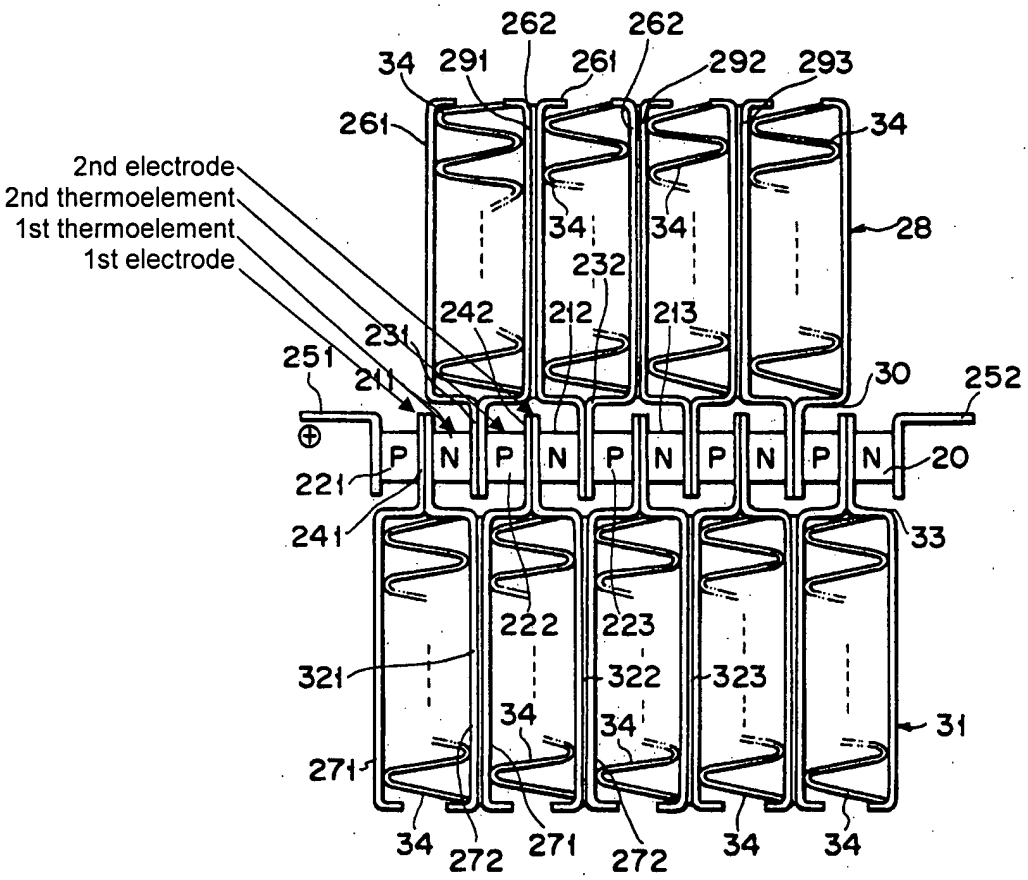
Takazawa et al does not explicitly disclose an electrode comprising a multilayered plate of metals as claimed.

Ghoshal teaches a thermoelectric device using nickel plated copper contacts to the thermoelements. (Column 5, lines 16-20)

It would have been obvious to one having ordinary skill in the art to substitute the nickel plated copper electrode of Ghoshal for the electrode of Takazawa et al, because the substitution of one known element for another would have yielded predictable results to one having ordinary skill in the art at the time of the invention. A nickel plated copper electrode would function as an electrode similarly to the copper or copper alloy disclosed by Takazawa et al, as would have been recognized by a skilled artisan. In addition, the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

9. Claims 15-17 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada et al (US 5,254,178) in view of Takazawa et al. (JP 2003-037300)

Yamada et al teach a thermoelectric device comprising all elements of claim 15 except for the phonon conduction impeding medium, as shown below in an annotated version of Figure 1 of Yamada et al. Insulating adhesive 321 reads on the instant dielectric material maintaining the spacing between the first and second electrodes.



Regarding claim 16, Yamada et al disclose multiple thermoelectric devices connected electrically in series and thermally in parallel. (Figure 1, each pair of p- and n-type materials with corresponding electrodes corresponds to a thermoelectric device, five are shown connected as claimed)

Yamada et al do not explicitly teach a phonon conduction impeding medium disposed between and thermally insulated from the first and second electrodes as claimed.

Takazawa et al teaches providing liquid metal at each junction of a thermoelement with an electrode (Paragraphs 0020 and 0024), and teaches that this improves the service life of thermoelectric modules. (Abstract)

It would have been obvious to one having ordinary skill in the art to modify the device of Yamada et al by providing liquid metal contacts at each junction between a thermoelement and electrode, as taught by Takazawa et al, because Takazawa et al teaches improved module service life by using liquid metal contacts. (Abstract)

In this combination, liquid metal, which is disclosed as being a phonon conduction impeding medium in the instant disclosure, is provided between the 1st thermoelement and the intermediate electrode that is positioned between the 1st and 2nd electrodes as labeled above. This liquid metal medium is positioned between the 1^{st} and 2^{nd} electrodes, and is thermally isolated from the 1^{st} and 2^{nd} electrodes by the 1^{st} and 2^{nd} thermoelement, meeting all requirements of claims 15 and 17. The medium is also directly coupled to the 1^{st} thermoelement, as required by claim 33.

10. Claims 1, 3, 8-10, 18, and 30-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fuschetti (US 5,429,680) in view of Nelson et al.

Regarding claims 1 and 18, Fuschetti et al disclose a thermoelectric structure (Figure 2) comprising: a first electrode (18); a second electrode (17); a first thermoelement (15) disposed between the first and second electrodes, and coupled to the first electrode; a phonon conduction impeding medium (Layer 33 adjacent to electrode 17 and above n-type material 15) coupled to the first thermoelement and thermally insulated from the first electrode. Specific to claim 18, Fuschetti discloses layers 33 adjacent to both electrodes 17 and 18 at either end of n-type thermoelectric material 15, these layers 33 read on the first and second phonon conduction impeding media. Note that Fuschetti discloses layers 33 as advantageously being pure lead (Column 4, lines 56-60), which is described in the instant specification as being a phonon conduction impeding medium. (Page 8, lines 1-6)

Regarding claim 3, Fuschetti discloses a phonon conduction impeding medium that is pure lead. (Column 4, lines 56-60)

Regarding claims 9 and 10, Fuschetti discloses the heat pump operating with a power source to provide cooling (i.e. Figure 2, power source 22) and operating in the presence of a temperature gradient to generate electricity. (Column 5, line 52-55)

Regarding claim 30, Fuschetti discloses a second phonon conduction impeding medium coupled to the first electrode. (Layer 33 adjacent to electrode 18)

Regarding claim 31, Fuschetti discloses a second phonon conduction impeding medium (Layer 33 adjacent electrode 17 and above p-type material 16) disposed between the second electrode (17) and a third electrode (19); and a second thermoelement (16) as claimed that is coupled to the second phonon conduction impeding medium and the third electrode (19).

Regarding claim 32, layers 33 are directly coupled to the respective thermoelements. (Figure 2)

Fuschetti does not explicitly disclose providing his heat pump with a dielectric material maintaining the spacing between the electrodes as claimed. Specific to claim 8, Fuschetti does not explicitly disclose connecting additional thermoelectric structures electrically in series and thermally in parallel.

Nelson et al disclose a thermoelectric heat pump provided with dielectric encapsulant 30 in the spaces between thermoelements. (Abstract; Figure 3; Column 2, line 40 - Column 3, line 12) Nelson et al also teach that the heap pump includes plural p-n material pairs connected electrically in series and thermally in parallel. (Figure 1; Column 2, lines 22-39)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the heat pump of Fuschetti by providing a dielectric encapsulant in the spaces between thermoelements, because Nelson et al teaches that such a dielectric material provides increased high shock capability to the devices, increasing their structural strength. (Abstract and Summary sections)

Specific to claim 8, it would also have been obvious to modify the device of Fuschetti et al by connecting plural p-n pairs electrically in series and thermally in parallel, as taught by Nelson et al, because it would allow tailoring of an increased voltage output of the device and allow cooling/heating of a selected larger area, regardless of the size of thermoelements available. This device design is ubiquitous in the thermoelectric art for this flexibility.

11. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fuschetti and Nelson et al as applied to claims 1, 3, 8-10, 18, and 30-32 above, and further in view of Gelb et al.

Fuschetti and Nelson et al teach a thermoelectric device as described above in addressing claim 1, 3, 8-10, 18, and 30-32 above.

Neither Fuschetti nor Nelson et al explicitly disclose the thermoelements comprising any of the claimed materials. Both references are silent concerning selection of thermoelectric materials.

Gelb et al teaches a thermoelectric heat pump comprising thermoelements made from bismuth telluride, which is a bismuth chalcogenide. (Example)

It would have been obvious to one having ordinary skill in the art to further modify the device of Fuschetti by specifically choosing to install bismuth chalcogenide thermoelements, as taught by Gelb et al, because Gelb et al teaches that bismuth telluride is an effective thermoelectric material for this purpose. (Example) The selection of a known material based on its suitability for its intended use supported a

prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

12. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fuschetti and Nelson et al as applied to claims 1, 3, 8-10, 18, and 30-32 above, and further in view of Ghoshal. (US 6,222,113)

Fuschetti and Nelson et al disclose a thermoelectric device as described above in addressing claims 1, 3, 8-10, 18, and 30-32.

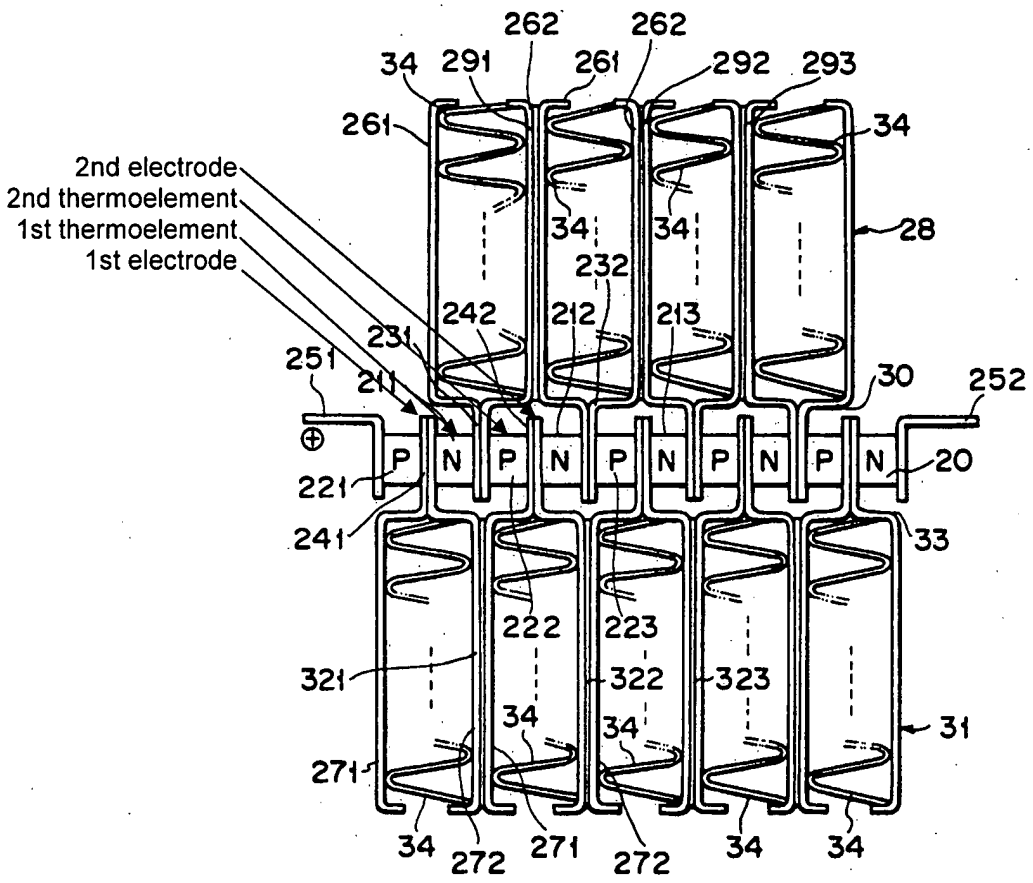
Neither Fuschetti nor Nelson et al explicitly discloses an electrode comprising a multilayered plate of metals as claimed.

Ghoshal teaches a thermoelectric device using nickel plated copper contacts to the thermoelements. (Column 5, lines 16-20)

It would have been obvious to one having ordinary skill in the art to substitute the nickel plated copper electrode of Ghoshal for the electrode of Fuschetti, because the substitution of one known element for another would have yielded predictable results to one having ordinary skill in the art at the time of the invention. A nickel plated copper electrode would function as an electrode similarly to the copper disclosed by Fuschetti, as would have been recognized by a skilled artisan. In addition, the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

13. Claims 15, 16, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada et al (US 5,254,178) in view of Fuschetti. (US 5,429,680)

Yamada et al teach a thermoelectric device comprising all elements of claim 15 except for the phonon conduction impeding medium, as shown below in an annotated version of Figure 1 of Yamada et al. Insulating adhesive 321 reads on the instant dielectric material maintaining the spacing between the first and second electrodes.



Regarding claim 16, Yamada et al disclose multiple thermoelectric devices connected electrically in series and thermally in parallel. (Figure 1, each pair of p- and n-type materials with corresponding electrodes corresponds to a thermoelectric device, five are shown connected as claimed)

Yamada et al do not explicitly teach a phonon conduction impeding medium disposed between and thermally insulated from the first and second electrodes as claimed. Yamada et al teach attaching the electrodes to the thermoelements using solder (Column 4, lines 50-57), while being silent concerning the type of solder used.

Fuschetti teaches attaching thermoelements to electrodes using relatively high-temperature solder, such as pure lead, in order to enable operation of the system at higher temperatures, thereby increasing efficiency and the rate at which heat is pumped. (Column 1, line 52 - Column 2, line 7; Column 2, lines 49-58; Column 4, lines 56-60)

It would have been obvious to one having ordinary skill in the art to modify the device of Yamada et al by specifically choosing a lead solder to connect electrodes to the thermoelements, as taught by Fuschetti, because Fuschetti teaches that lead solder can be used at higher temperatures than conventional solders, enabling operation of the system at higher temperatures, thereby increasing efficiency and the rate at which heat is pumped. (Column 1, line 52 - Column 2, line 7; Column 2, lines 49-58; Column 4, lines 56-60)

In this combination, lead, which is disclosed as being a phonon conduction impeding medium in the instant disclosure, is provided between the 1st thermoelement and the intermediate electrode that is positioned between the 1st and 2nd electrodes as labeled above. This lead material is positioned between the 1^{st} and 2^{nd} electrodes, and is thermally isolated from the 1^{st} and 2^{nd} electrodes by the 1^{st} and 2^{nd} thermoelements,

meeting all requirements of claim 15. The medium is also directly coupled to the 1st thermoelement, as required by claim 33.

Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Jeffrey T. Barton whose telephone number is (571) 272-1307. The examiner can normally be reached on M-F 9:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JTB
17 December 2007

NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700